The Hydrogen Storage Program and HySCORE: A Brief Description

The **Hydrogen Storage program** supports research and development (R&D) of technologies to lower the cost of near-term physical storage options and longer-term material-based hydrogen storage approaches. The program conducts R&D of low-pressure, materials-based technologies and innovative approaches to increase storage potential and broaden the range of commercial applications for hydrogen.

These advanced-materials activities focus on novel materials with the potential to store hydrogen near room temperature at low-to-moderate pressures and at energy densities greater than either liquid or compressed hydrogen.

Key activities include:

- Improving the energetics, temperature, and rates of hydrogen release;
- Pursuing advanced concepts include high-capacity metal hydrides, chemical hydrogen storage materials, and hydrogen sorbent materials, as well as novel material synthesis processes;
- Setting forth figures of merit for storage capacity.

The program also conducts efforts on the integration of novel hydrogen storage materials into complete, engineered systems, focusing on developing innovative solutions to thermal management, material packaging, and control strategies to provide compact, efficient, and cost-effective systems.

HySCORE—or Hydrogen Storage Characterization Optimization Research Effort—is a National Renewable Energy Laboratory (NREL)-led national laboratory collaboration between NREL, Pacific Northwest National Laboratory (PNNL), Lawrence Berkeley National Laboratory (LBNL), and the National Institute of Standards and Technology (NIST). HySCORE brings together internationally recognized leaders in hydrogen storage materials characterization and development.

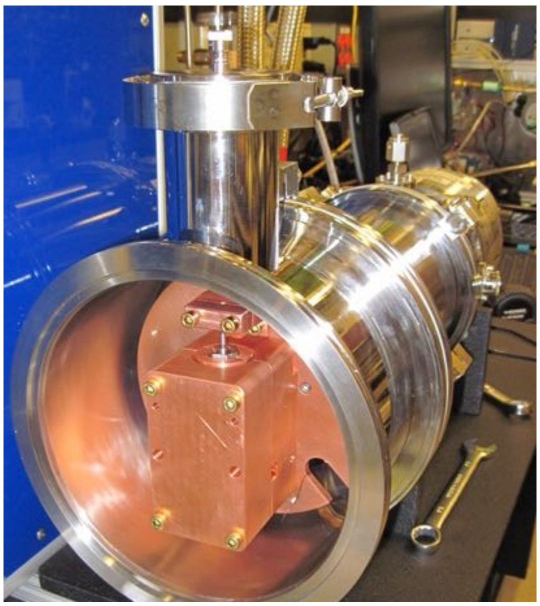
This collaboration is predicated on a synergistic approach to further develop the key core capabilities necessary for accurately evaluating hydrogen storage materials capacity, kinetics, and sorption/desorption physio-chemical processes.

Furthermore, these experts also conduct an experimental-modeling collaborative approach to utilize the core capabilities developed to rapidly define, model, synthesize, and characterize the appropriate materials necessary for achieving the 2020 Hydrogen Storage goals set forth by the U.S. Department of Energy. The approach is multifaceted to mitigate risk and ensure success as we bridge the gap between physisorption and chemisorption to provide the basis for a new generation of hydrogen storage materials technologies.

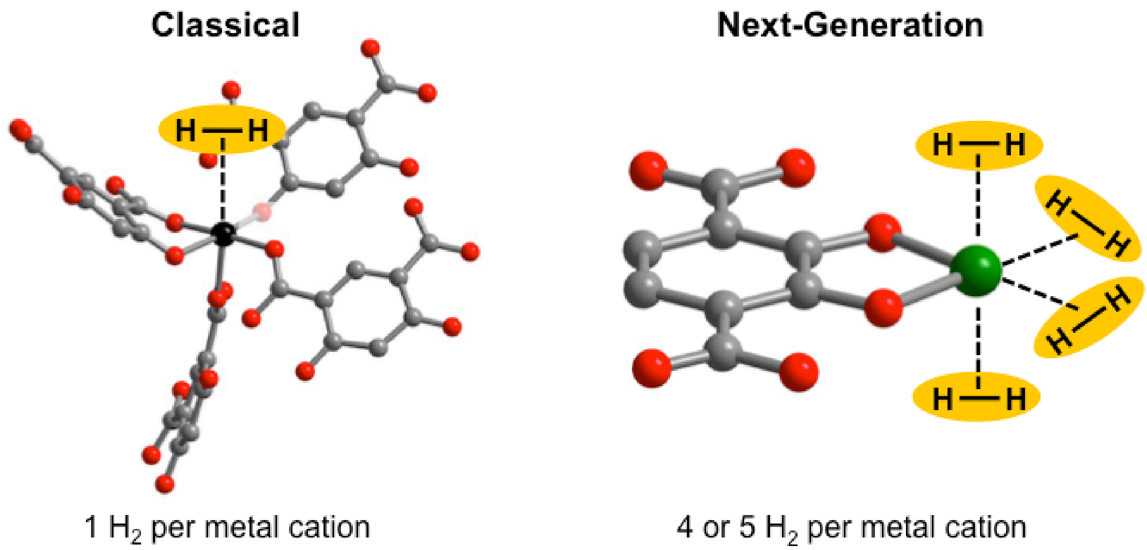
Our principal materials-based objective is to develop new materials that have volumetric capacities > 45 g/L and isosteric heats of hydrogen adsorption in the range of 15–20 kJ/mol—with the caveats of acceptable gravimetric capacities and the ability to deliver on-demand H_2 at an appropriate rate and pressure. To capture the benefits of reduced system cost and forecourt compression energetics, the maximum overpressure would be < 100 bar of hydrogen, with a delivery temperature of greater than 150 K and as close to ambient temperature as possible.

The HySCORE team leads are:

- NREL—Tom Gennett and Phil Parilla
- PNNL—Tom Autrey and Mark Bowden
- LBNL—Jeff Long and Martin Head-Gordon
- NIST—Craig Brown and Terry Udovic



New Variable temperature (40 – 400K) cryo-compressor sample holder for PCT measurements developed at NREL.



TLBNL illustration of a current research thrust to binding multiple H2 molecules per metal cation in a framework material.